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Planning, designing and maintaining Hospital laundry to reduce carbon foot prints and to make it energy efficient and cost competitive.

HOSPITAL ADMINISTRATION

Dr.M.Yamuna Rani Post Graduate Resident, Department of Hospital Administration, JSSMC & H, Mysuru, Karnataka.

Dr. G.Sravana Kumar Assistant Professor, Department of Hospital Administration, JSSMC & H, Mysuru, Karnataka.

Dr.R.K.Chaturvedi Professor & Head, Department of Hospital Administration, JSSMC & H, Mysuru, Karnataka.

Dr J.N Rao Professor, Department of Hospital Administration, JSSMC & H, Mysuru, Karnataka.

ABSTRACT

Linen and Laundry services are considered to be one of the most important supportive services in a hospital. No hospital can pursue its activity of patient care even for a moment without the aid of proper linen service.1 Purpose of the study was to get an informative and detailed picture of the resource utilization, planning and designing of the Laundry in a cost effective manner. In conventional Planning and Designing of laundry the size and area is related to number of beds which doesn't seem to be logical as the main determining factors is the load of linen and clothes to be washed like number of Operation theatres, ICU beds and day care beds where linen may have to be changed more than once thus the area requirement for 100 bed psychiatric centre and cardiac centre would be drastically different. According to Dr. J .R. Mc Gibony, area requirement for a laundry in teaching hospital should be 5800 sq.ft.2According to a survey of Delhi hospitals in 1978 is 10 sq.ft./bed or 10 sq.ft./5 lbs of linen.3 Conventionally steam based drying and calendaring system was traditionally considered more economical which was not found to be true.

We conducted a study of laundry services in an 1800 bedded tertiary care teaching hospital and found that in a steam driven laundry system total energy expense contributed to 58% of total cost which includes diesel cost (51%) and electricity (8%). After shifting to electricity driven laundry system, the energy cost decreased to 24% of the total cost, giving a savings of 35%.

This paper has tried to give a comprehensive approach to planning and designing consideration and economical operations of laundry system of hospital.

KEYWORDS:

Laundry, Carbon footprints, Energy efficient and Cost competitive.

INTRODUCTION:

Linen and laundry services are responsible for providing safe, clean, adequate and timely supply of linen to the user units of the department at right time, right price and right place.[4]

For patient and their attenders, linen plays an important role as they use linen all 24 hours and is essential requirement for Operation theatres, ICUs, all wards and departments. The cost of disposable linen is high and increases quantity of waste, therefore by improving efficiency and productivity of linen and laundry services will improve the image of the hospital and also considered safe and cost effective[4] with due care to quality.

Table No. 1: Planning and designing of laundry services based on load of linen and clothes.

S. No	Description	Quantity (Nos.)	Estimated Load (gms)	Total Estimated load (gms)
A	**INPATIENT ROOMS**			
1	Bed Sheet	2	500	1000
2	Pillow Cover	1	150	150
3	Draw Sheet	1	300	300
4	Bath Towel	1	750	750
5	Face Towel	1	250	250
6	Patient Uniform	1	500	500
7	Attendent's Bed Sheet	1	450	450
8	Attendent's Pilow Cover	1	150	150
9	Curtains (Monthly)			
	Total			**3550**
B	**OPERATING ROOM**			
1	Large Sheets	2	400	800
2	Small Sheets	5	200	1000
3	Extra Large Sheets	1	450	450
4	Surgeons Gown	2	500	1000
5	Asst.'s Gown	2	500	1000
6	Sponges (re-usable)	6	100	600
7	Caps & Face Mask (re-usable)	6	50	300
	Total			**5150**
C	**UNIFORM LOAD**	1120	500	**560000**
D	**DIAGNOSTIC ROOMS**			
1	Bed Sheet	2	450	900
2	Pillow Cover	2	150	300
3	Draw Sheet	1	300	300
4	Patient Gown	1	500	500
5	Curtains (Partitions) – Monthly	1		
	Total			**2000**
E	**CONSULT ROOMS**			
1	Bed Sheet	2	450	900
2	Pillow Cover	2	150	300
3	Hand Towel	4	300	1200
4	Curtains (Partitions) – Monthly	1		
	Total			**2400**

SUMMARY OF LOAD FOR HOSPITAL

S.No.	Areas	Head Count	Weight of Single Set	Total Weight in Kg
A	Inpatient Room	308.8	3550	1096
B	Surgeries	48	5150	247
C	Uniform	1120	500	560
D	Diagnostic	130	2000	260
E	Consult Rooms	117	2400	281
	Total		2444	
	Add 10% for other areas			2689

	Load considering 12 Hrs. Operation			224
	EQUIPMENT SELECTION			
S. No.	**Description**	**No.**	**Capacity (Kgs)**	**Total Capacity (Kgs)**
1	Washer/ Hydro Extractor	3	65	195
	Sluice	1	30	30
	Hydro Extractor	1	25	25
2	Tumble Dryers	3	50	150
3	Flat Work Ironer	1		
4	Uniform Pressing	4		
Note :				
1	Load has been calculated for 350 Beds			
2	Load for blankets and curtains will be taken care in overall diversity			

The process of cost-analysis has become a resource tool for finance management in hospitals. Costing also helps to assess the efficiency and effectiveness of functions and their cost implications with a view to contain cost. The exercise of unit costing involves the determination of the cost of a single unit of any product or service.[5]

Aim: Study of Hospital laundry services to make it energy efficient and cost competitive and to reduce carbon foot prints

Objectives:

1. To devise correlating parameter for laundry area based on actual linen requirement in kg.
2. To determine the various cost involved in the operation of a laundry like energy consumption, washing detergents, hydro extraction, drying and calendaring in a large tertiary-care teaching hospital.
3. To calculate the total cost incurred per kg in processing the linen for final use.

Materials and Methods:

Hospital during planning stage was designed for steam based laundry system consisting of water softening plant and boiler, used for drying and calendaring of linen. Got an opportunity to study the steam laundry system for a period of 2 months (Retrospective study). But later found unreliable due to frequent break down in steam supply system due to scaling and servicing issues.

So Hospital searched for other alternative source leading to conversion of steam based laundry system to electrical laundry system by replacing steam drier and calendaring machine with electrical drier and calendaring machine.

Conducted a prospective study for 2 months after installation of electrical laundry system.

Table no. 2: Following tabular column illustrates the comparative advantage of steam vs Electricity based laundry system

Steam based laundry system	**Electricity based Laundry system**	**Remarks**
Human resource(23)	Human resource(22)	1 Boiler operator post eliminated
Steam calendaring machine(process 45 sheets/hour)	Electrical calendaring machine (Process 90 sheets/hour)	Electrical calendar machine processes additional 45sheets for same duration of time.
Diesel	x	Eliminated
Water softener plant	x	Eliminated
Space	Space for water softener and Boiler eliminated	16% of area saved in laundry.
Detergent	Detergent	Negligible difference

A study of the Laundry services was conducted for a period of 60 days with a view to understand the physical facilities, staffing pattern, policies and procedures, layout and workflow.

A retrospective study of the resource utilization of the Laundry for a period of 60 days was done with a view to find out the various cost-factors involved in the operation of a laundry facility. This was achieved by getting a detailed consumption report from the stores, discussions with the mechanical, electrical and the finance department. Cost-Accounting principles were kept in mind while compiling the entire database of information. Cost per operation was calculated.

With the database in hand, the high-cost areas came into light. Keeping these in mind various strategies were thought about on how to re-schedule the laundry process, so as to achieve cost-reduction and higher productivity.

It was then that a database of the workload on the washing machine, Hydro extractor, drier, calendar machine was studied, so as to know the effective usage of each individual equipment. The total load of laundry was acquired from the records maintained in the department. The average running time of each machine for one month was taken for the calculations.

Work-study was done with the objective of most effective use of plant and human effort.

Various steps involved in the laundry process were studied. Each activity was critically analysed to combine, rearrange, eliminate and simplify the operations.

Taking into account the findings of the above study few cost-saving methods were devised.

Observation and Discussion

Based on observation of laundry workload which was approximately 27,000 Kg of linen per month, the following operational costs and fixed costs were analysed.

Table no. 3: The table consists of monthly consumption and cost of chemicals, diesel, electricity and water in laundry

1. OLD CHEMICALS CONSUMED COST / MONTH

BRANDNAME	QUANTITY/MONTH	COST/MONTH
1.MICROX-1000 ULTRA	105kg	105×95 = 9975
2.MICROX-50 BL	66kg	66×55 = 3630
3.MICROX-2000	95kg	95×70 = 6650
4.MICROX-HYPO	64kg	64×50 = 3200
5.MICROX-SOFT	80kg	80×110 = 8800
TOTAL	410kg	INR 32,255

Total INR 32,255

2. DIESEL CONSUMED FOR STEAM GENERATION (which is used for calendar machine & steam drier)/MONTH

Diesel	QUANTITY/MONTH	COST/MONTH
Cost of 1 litre is INR 60	6000lts(200lts/day)	3,60,000

For 1 litre of diesel combustion, 2.63 kg of CO_2 is emitted.[6] So for 6000 litres of diesel combustion, 15780 kg of CO_2 is emitted.

INR 3,60,000

3. ELECTRICITY CONSUMPTION IN LAUNDRY/MONTH

Electricity	QUANTITY/MONTH	COST/MONTH
Cost of 1 unit is INR 6.7	7920kw(264kw/day)	53,064

INR 53,064

4. ACTUAL WATER CONSUMPTION IN LAUNDRY/MONTH

Water	QUANTITY/MONTH	COST/MONTH
INR 6.8/1000 lts of water	979200lts (32640lts/day)	6,658

INR 6,658

5. COST OF EXISTING EQUIPMENTS IN LAUNDRY (RETROSPECTIVE STUDY)

Item	Quantity	Total price
Washing Machine (92kg)	2	4,28,220
Hydro extractor(50kg)	1	1,24,020
Tumble Drier(25kg)	1	1,64,295
Calendar Machine (Capacity: 45sheets/hour)	1	7,01,145
Drum Washer(150kg)	1	1,80,000
Hygiene washer(50kg)	1	1,50,000
Tumble Drier(50kg)	1	1,20,000
Hydro extractor	1	1,42,500
Boiler along with water softener plant	1	18,27,348
Taxes	4,48,097	
Transportation	50,998	
Total	INR 43,36,623	

Total cost of equipment's
= INR 43, 36,623
Depreciation of equipments@10% per annum.
Fixed cost after adjusting depreciation/month = **INR 36,138.**

Study after switching over to Electric Calendar machine + Electric drier

Based on observation of laundry workload which was approximately 40,000 Kg of linen per month, the following operational costs and fixed costs were analysed.

Table no.4: The table consists of monthly consumption and cost of chemicals, electricity and water in laundry

1. NEW CHEMICALS CONSUMED COST / MONTH

BRANDNAME	QUANTITY/ MONTH	COST/MONTH
1. SL WHITE SUPREME	33.55kg	33.55 × 121.28 = 4068.944
2. SL LLD SUPREME	81.15kg	81.15 × 117.60 = 9543.24
3. SL XYMO	16.65kg	16.65 × 220.50 = 3671.325
4. SL CLEAN SOFT HP	122.9kg	122.9 × 99.23 = 12195.367
5. SL HYPO MATIC	159.45kg	159.45 × 33.08 = 5274.606
TOTAL	**413.7kg**	**INR 34,753**

Total INR 34,753

2. DIESEL CONSUMED FOR STEAM GENERATION
NIL(Carbon footprints are eliminated)

3. ELECTRICITY CONSUMPTION IN LAUNDRY/MONTH

Electricity	QUANTITY/MONTH	COST/MONTH
Cost of 1 unit is INR 6.7	12660kw(422kw/day)	84,822

INR 84,822

4. ACTUAL WATER CONSUMPTION IN LAUNDRY/MONTH

Water	QUANTITY/MONTH	COST/MONTH
INR 6.8/1000 lts of water	765000lts (25500lts/day)	5,202

INR 5,202

COST OF EQUIPMENTS IN LAUNDRY

Item	Quantity	Total price
Electrical Calendar machine. (Capacity : 90 sheets/hour)	1	8,00,000
Electric tumble drier 25kg	1	2,00,000
Total		**INR 10,00,000**

Total cost of equipment's
= INR 35, 09,275
Depreciation of equipments@10% per annum.
Fixed cost after adjusting depreciation/month = **INR 29,244.**

Table no. 5: Operational and total cost of laundry/month before and after removal of boiler

Operational cost of laundry/month

Operational cost of laundry/month				
Consumables	**BEFORE**		**AFTER**	
Total linen washed(in Kg)	899kg/day	26970kg/ month	1316kg/day	39471kg/m onth
	Units	**Cost/ month**	**Units**	**Cost/ month**
Detergents	410kg*	32255*	414 kg*	34753*
Human Resource Salary	23	244512	22	236636
Diesel	180-200 litres/day	360000	NIL	NIL
Electricity	264kw/day	53064	422Kw/day	84822
Water	32640lts/day	6658	25500L/day	5202
Total	**664234**		**326660**	
Cost incurred/kg	**25**		**8**	
*Cost of detergents though shown but not considered in calculation.				

Total cost (including operational and fixed cost)		
Total Cost /month	**Before**	**After**
Operational cost/month	664234	326660
Fixed cost after depreciation/month	36138	29244
Total cost	**700372**	**355904**
Total linen washed(in kg)/month	26970	39471
Cost incurred/kg	**26**	**9**

Conclusion: In the comparative work study, it was found that major operational cost is incurred by operating boiler (Diesel + water) which costs around INR 3, 61,456.However,the minor increase in electricity due to electrical calendar machine and drier was offset by elimination of operating boiler and diesel consumption(Carbon foot prints).Per Kg operational cost has been reduced from INR 25 to INR 8 which is INR 17.Detailed work-study and other strategic decisions resulted in the stoppage of boiler operation. Savings of INR 3, 69,332 were made on the salary of one boiler operator, diesel and water. Area of 16 % is saved in laundry equipment area. The total cost of operating the laundry was reduced by 35%. Reduction of wastage, leading to increased productivity, through better utilization of man and machine was the bottom-line.

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